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of the

American Association of Jesuit Scientists

Eastern States Division

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Includes

PROCEEDINGS
of the

TWENTY-FOURTH ANNUAL MEETING
August 30, 31 and September 1, 1949
FORDHAM UNIVERSITY

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Bulletin of the American Association of Jesuit Scientists

EASTERN STATES DIVISION

VOL. XXVII MAY, 1950 NO. 4

NOTICE TO AUTHORS

Manuscripts are to be submitted to associate editors of the appropriate section and *may* be submitted directly to the editor in chief. Clear manuscript, preferably typed, with wide margin to the left, with double spacing between lines, is desirable. Please try to follow the typographical style of the most recent issue of the Bulletin. Line drawings should be submitted on Bristol board, or similar material, and done in India ink. Figure number should be written on this in pencil. Titles for drawings, with figure numbers, should be typed on a separate sheet. Please try to minimize footnotes. Appended references and bibliographies, clearly so marked, should be done in the style of the A.A.A.S. publication, *Science.*

Program

Twenty-fourth Annual Meeting

of the

AMERICAN ASSOCIATION OF JESUIT SCIENTISTS

EASTERN STATES DIVISION

Fordham University

AUGUST 30, 31 AND SEPTEMBER 1, 1949

FIRST GENERAL MEETING

Tuesday, August 30, 1949 at 7.30 P.M. in Freeman Hall

Address of Welcome — Rev. Lawrence J. Walsh, S.J., *Provost*

Appointment of Committees
Report of the Committees
Report of the Secretary

PRESIDENTIAL ADDRESS: Biological Evolution is a Fact — Rev. John A. Frisch, S.J.

Editorial Policy: *The Jesuit Science Bulletin* — Rev. Bernard A. Fiekers, S.J.

MEETINGS OF THE SECTIONS

These meetings begin on Wednesday at 10.00 A.M. Each section should determine its own time of meeting for Wednesday and Thursday afternoons.

BIOLOGY SECTION

Chairman's Address: A Technique Employed in Experiments on Parthenogenesis in Rabbit Ova — Rev. Joseph F. Busam, S.J.

The "Killer Factor" in *Paramecium Aurelia* — Rev. John A. Frisch, S.J., *President*

Alcoholism — Rev. James L. Harley, S.J.

Recent Developments in Chromosome Studies — Rev. Michael P. Walsh, S.J.

The Training of Research Workers — Rev. John N. Haas, S.J.

The Genetics of the Rh Blood Group — William K. Masterson, S.J.

CHEMISTRY SECTION

Chairman's Address: Some New Experiments in Physical Chemistry — Rev. James J. Pallace, S.J.
Discussion of the Minimum Standards of the American Chemical Society — Rev. Albert F. McGuinn, S.J.
A Simple Demonstration of the Colloidal and Crystalline State of the Same Substance — Rev. Albert F. McGuinn, S.J.
The Vitreous State — Rev. Joseph J. Sullivan, S.J.
A System of Stoichiometry — Rev. Bernard A. Fickers, S.J.
A Home-Made Photographic Copying Outfit — Rev. Joseph A. Martus, S.J.
Teaching the Metric System — Frederick J. Dillemuth, S.J.
Gravity Filtration in the Preparation of Permanganate Solutions — George A. Duffy, S.J.

MATHEMATICS AND PHYSICS SECTIONS

Chairman's Address: The Co-operative Physics Tests at Georgetown — Rev. Joseph F. Cohalon, S.J. Chairman of the Physics Section
Size, Distance, Shape and Color of Objects in Psychophysics — Rev. John A. Tobin, S.J.
Some Coupled Systems in Physics — Robert O. Brennan, S.J.
Color and Structure of Complex Molecules — Joseph F. Mulligan, S.J.
Father Secchi and Stellar Spectra — Martin F. McCarthy, S.J.
A Simple Transposition of the Plane which leaves all Plane Figures of the Same Shape — Rev. Edward C. Phillips, S.J.
Notes on Dimensional Analysis — Rev. Stanley J. Bezuszka, S.J.

SECOND GENERAL MEETING

(Business and Final Meeting)

Thursday, September 1, 1949 at 10.00 A.M., Freeman Hall

Business Meeting of the ASSOCIATION
Report of Secretaries of the Sections
Report of the Nominating Committee
Election of Officers
New Business
Report of the Resolutions Committee

SECRETARY'S REPORT

The twenty-fourth annual meeting of the American Association of Jesuit Scientists, Eastern States Division, was held at Fordham University, August 30, 31 and September 1, 1949.

FIRST GENERAL SESSION

The meeting was called to order by the Reverend John A. Frisch, President of the ASSOCIATION, at 7.30 P.M., August 30, in the physics lecture room of Freeman Hall. A very cordial welcome was extended to the members of the Association by the Rev. Lawrence J. Walsh, Provost of the University. Father Walsh spoke in the name of the Rev. Laurence J. McGinley, Rector and President of the University, who was unable to be present.

The minutes of the twenty-third annual meeting, held at Holy Cross College, Worcester, Mass., August 31 to September 2, 1948, were read, and accepted as corrected.

The Committee on the Index of the BULLETIN of the ASSOCIATION reported progress in the drawing up of the index, and its existence was extended another year for the completion of the work.

The President named the Rev. Bernard A. Fiekers, the Rev. Eugene A. Gisel, and the Rev. Arthur A. Conniff to the Committee on Nominations, and the Rev. Joseph P. Kelly, the Rev. James J. Pallace, and the Rev. Edward S. Hauber to the Committee on Resolutions.

The President reported the proceedings of the meeting of the Executive Council, held immediately previous to the General Session of the ASSOCIATION:

1. the appointment of the Rev. Bernard A. Fiekers to succeed the Rev. Gerald F. Hutchinson as Editor of the BULLETIN.

2. The proposal was made that a set of by-laws be written to outline the procedure on admission of new members, on programming the meetings, on determining the time of the annual meetings, and on all similar matters of detail.

3. the proposal was made that an account be sent to the Rev. Fathers Provincial of the three Provinces, of the accomplishments of the ASSOCIATION, in particular, of the new members admitted, each year.

The President announced the approval by the Rev. Fathers Provincial of the proposal that scholastics be permitted to attend the meetings of the ASSOCIATION without being required to present a paper. Permission to attend is automatically extended to those scholastics who are engaged in teaching or in specialized study of the sciences.

The announcement was made that an exhibit of Kodachrome materials and processes would be open to the members on Wednesday evening, August 31. The exhibit was sponsored by the Rev. Alfred Purcell.

Father Fiekers recommended to the personal concern of each of the members, the quality of the ASSOCIATION'S publication, urging that its continued merit depends on the wealth of material submitted for publication.

The Presidential Address, *Biological Evolution is a Fact*, was delivered by the Rev. John A. Frisch, and the meeting was adjourned at 9.15 P.M.

SECOND GENERAL SESSION

The second and final general session was called to order by the President on Thursday morning at ten in the Physics Lecture Room of Freeman Hall. The President expressed his gratitude to the committees on arrangement for the annual meeting: the chairmen: Rev. Roche G. Belmonte, *Reception;* Rev. Howard A. McCaffrey, *Hospitality;* Rev. Eugene A. Gisel, *Publicity;* Mr. Thomas F. Egan, *Entertainment;* and Rev. James J. Pallace, *Program.*

Sectional secretaries reported from their sections the following elected officers *Biology:* Rev. Francis X. Flood, Chmn., Mr. James A. McKeough, Secy.; *Chemistry:* Rev. George J. Hilsdorf, Chmn., Mr. Arthur G. Kehoe, Secy.; *Mathematics:* Rev. Joseph A. Persich, Chmn., Mr. William B. Cogan, Secy.; *Physics:* Rev. Francis J. Heyden, Chmn., Mr. Martin F. McCarthy, Secy.

Upon report of the nominating committee and vote of the ASSOCIATION, Rev. Francis J. Heyden of Georgetown University and Rev. Vincent F. Beatty of Loyola College in Baltimore were elected President and Secretary of the ASSOCIATION, respectively. Father Heyden took the chair.

The Resolutions Committee presented the following resolutions: Be it resolved:

1. that the American Association of Jesuit Scientists, Eastern States Division, express its sincere appreciation to the Rev. Father President, to the Rev. Father Superior, and to Father Minister of Fordham University for their cordial reception and gracious hospitality during our convention.

2. that the ASSOCIATION express its gratitude to the various committees whose generosity contributed much to the smooth functioning of the convention.

3. that the ASSOCIATION express its commendation to the Rev. Bernard A. Fiekers, who so willingly assumed the burden of Editorship of the BULLETIN in an emergency.

4. that the ASSOCIATION extend a vote of thanks to its President of last year, Father Frisch, and to the officers of the ASSOCIATION for their splendid work of the past year.

5. that the Secretary of the ASSOCIATION be instructed to send the expression of our appreciation to the authorities of Fordham University.

The above resolutions were approved as presented.

A list of the members present at the meeting was drawn up.

As a matter of new business, Father Joseph P. Kelly moved that the ASSOCIATION empower the Executive Council to amend the Constitutions in such a way that there would be greater permanence of membership in the Executive Council, and hence greater continuity in the efforts not only of the Executive Council but of the entire ASSOCIATION. The motion was seconded and after a brief

discussion, carried. Several recommendations as to how that permanence might be effected, were made from the floor, but definite action was left to the Executive Council.

The date of next year's meeting was discussed.

The motion for adjournment was made, seconded and carried at 11.30 A.M.

Respectfully submitted,

(Rev.) Harry A. Boyle, S.J.
Secretary

IMPORTANT NOTICE EXCERPTED FROM THE EXECUTIVE COUNCIL'S MINUTES

The Executive Council of the ASSOCIATION met in the Physics Amphitheatre of Freeman Hall on September 1, 1949 at 11.00 A.M., immediately after the closing meeting of the convention. The following members were present: Fathers Heyden, Beatty, Flood, Hilsdorf, Persich and Kelly. Fathers Boyle, Fiekers and Frisch also attended. Recently empowered by the ASSOCIATION to amend the constitutions in favor of greater continuity of the council, executive council took the following action: President shall be elected for one year followed by two years on the executive council; Secretary shall be elected for three years followed by one year on the executive council; Sectional chairmen shall be elected for three years. Terms of the present incumbents expire as follows: biology in 1952; chemistry in 1952; mathematics in 1951 and physics in 1951. Treasurer and Editor of the Bulletin are members of the executive council, and along with the Chairman of the Section of Philosophy and Science, have terms of indefinite duration.

Biology

A TECHNIC EMPLOYED IN EXPERIMENTS ON PARTHENOGENESIS IN RABBIT OVA

Abstract

Rev. Joseph F. Busam, S.J., Chmn.

Parthenogenesis or the development of an unfertilized egg may be studied in the rabbit by activation of ovarian or tubal ova. The great number of eggs necessary for successful execution of parthenogenetic experimentation in this instance are obtained by bringing a large number of follicles simultaneously to the preovulatory level, using the follicular stimulating hormone (FSH) from the sheep's pituitary.

Ovarian ova are obtained by pricking a ripe preovulatory follicle of an excised ovary, permitting the ova to drop into rabbit serum. Such ova are considered to be unactivated.

To obtain tubal ova, it is necessary to induce ovulation. This is brought about by an intravenous injection of utealizing hormone (LH) made after the above mentioned injections of the follicular stimulating hormone. Ten to twelve hours after this injection the animal is killed and the fallopian tubes removed. By means of a sterile capillary pipette, containing sterile rabbit serum, the fallopian tubes are flushed and the ova collected in a watchglass.

Heat or hypertonic solutions may be used to activate both ovarian and tubal eggs. Activated ova may be cultured in sterile Carrel flasks, or transplanted into pseudopregnant rabbits.

In transplantation, a pseudopregnant rabbit is given a light anaesthesia, and the body cavity is opened. Activated ova are placed in the upper fifth of the fallopian tube by means of a capillary pipette of special design. Great care must be taken not to inject air or excess fluid along with the eggs. Activated eggs properly placed will descend in the fallopian tubes in a normal manner.

Tubal ova may also be activated by applying to the fallopian tubes of a pseudopregnant rabbit a small jacket through which ice water is circulated.

Ova, activated in vitro and cultured, may undergo development —in general only up to the implantation stage. Ova, activated in vitro and transplanted into the fallopian tubes of pseudopregnant rabbits, act quite normally if they have begun to cleave in vitro. A number of young have been produced parthenogenetically.

RECENT ADVANCES IN CHROMOSOME RESEARCH

Abstract

Rev. Michael P. Walsh, S.J.

Textbooks in various biological subjects have failed to keep up with the progress that has been made in recent years on the subject of mitosis and meiosis. The main purpose of this paper was a discussion of the errors commonly found in ordinary textbooks on the subject of mitosis.

The various phases of mitosis, the structure and morphology of chromosomes, reduplication of chromosomes, coiling and the number of strands in a chromosome were some of the subjects that were discussed in detail.

Since a large amount of recent research in cytology has been along experimental lines, some time was devoted to a consideration of this aspect of cytological research. The methods that are being used to determine the chemistry of chromosomes were described in detail. Finally the subject of heterochromation and enchromation, which has received a good deal of emphasis in recent cytological literature, was reviewed.

ON THE TRAINING OF RESEARCH WORKERS

Abstract

Rev. John N. Haas, S.J.

By the term of *research workers* is understood scientists who are able to do outstanding work in a particular field of science and who at the same time are able to instruct others in doing the same type of work. There is a certain need to have *ours* so qualified. They increase greatly the reputation of our universities, attract outstanding students and financial aids, they are the *viri eminentes* demanded by our Father General, they will be able to deal in an authoritative manner with questions which come up in the field between science and philosophy. Although they should be gifted with some extraordinary qualities and inclination for such work, much can be done for their training. They must be given the opportunity to carry on studies when others finish them and to become associated with outstanding authorities of their field. Together with these they should work in well equipped laboratories as research fellows or research assistants for quite a number of years. This type of postgraduate study usually cannot be carried on in our own institutions since advanced work requires too much equipment—usually not at hand in our own schools. There are many difficulties connected with this type of work and training, the basic one seems to be lack of understanding for the necessity of outstanding workers and the peculiar character of their training.

THE GENETICS OF THE Rh BLOOD GROUPS

Abstract

William K. Masterson, S.J.

It seems likely that research work now being carried on in the Rh blood groups will contribute to fundamental knowledge in the fields of Genetics and Ethnology. This paper deals with an explanation of the Rh groups according to the British system of nomenclature devised by Fisher. According to Fisher's theory, inheritance of the Rh antigen is controlled by three pairs of allelic genes which are found on closely associated loci. Proof is offered that the linkage is so close, that crossing over is ruled out. This theory is opposed to Wiener's theory which states that all varieties of Rh antigen are inherited by means of a single gene, with multiple alleles, present at a single locus.

ON PRE-MEDICAL EDUCATION*

Rev. P. H. Yancey, S.J.

Some thirty years ago, when the writer first taught biology at Spring Hill, the medical schools began to tighten up on their requirements and to emphasize the sciences as pre-requisites for admittance.

*Reprinted with permission from the *Mendelian*, 20 no. 3, 23 (Feb. 1950).

As a result the time-honored A.B. degree with its stress on the humanities was forsaken for a "pre-medical" course, heavy with biology, chemistry and other sciences.

Spring Hill, wanting to give its pre-medical students the kind of training the medical schools seemed to want them to have, called on the writer, who was then a graduate student in St. Louis University where the biology department is closely connected with the medical school, to draw up a curriculum which would meet these requirements and also comply with our Jesuit system of education. This he did from his experience both as a teacher and as a student in a medical school. The curriculum called for three or four years (depending on whether a degree was wanted) of both biology and chemistry, as well as a major in scholastic philosophy, and the rest of the subjects ordinarily required for graduation.

As can be seen, this was a rather heavy program. Not many students could carry it out creditably. The result was that during the eighteen years that this curriculum has been in force at Spring Hill not too many students have completed it and been accepted by medical schools. However, those who have been accepted, with very few exceptions (to be precise, three in the eighteen years), not only got through but usually did well.

One particular case comes to my mind. It is of a boy who came to me after Christmas in his junior year and complained that he had been rejected by the medical school he had applied to because of low grades. He could not deny the grades but he said he felt that he was as well or better prepared than some of his former high school classmates who had gone to other colleges and made better grades and had been accepted by medical schools. I told him that while it might be difficult for him to get in, if he did get in I would guarantee that he would stay in, provided he continued to apply himself as he had. He did better work in the rest of his junior year and in his senior year and was accepted by his state university which had a two-year medical school. There he did so well in his freshman year that before the end of it he was *invited* by the four-year school, which had previously rejected him, to transfer to it immediately. He did not do so until he had finished his sophomore year but he continued his good work there and even led his class in some quarters. Later he received a residency at the Mayo Clinic.

I do not recount these things for the purpose of "patting ourselves on the back," but because of a radical change which I have observed in the admitting policies of the medical schools. Some are openly advising the colleges that they want a "minimum of science" from their applicants. Others, while not doing this explicitly, do so implicitly, by stressing general education and knowledge of current affairs and also by accepting students on the basis of high quality quotients regardless of the subjects by which these high ratings were gained.

Far from criticising this reversal on the part of the medical schools to a broad liberal education as opposed to a narrow scientific one, I am very much in favor of it as is shown by a paper which I published on the subject a couple of years ago (Cf. *Must Scientists Be Ignorant?* Bios. *19* (3) 185). After all it is the well-tried Jesuit system. However, there is evidence that the teachers in medical schools, especially in the freshman class, do not see eye to eye with the administrators on this point. The result is that some students who have been accepted on the basis of their high grades in college in non-science subjects have found the going so difficult in medical school that they have either failed or dropped out voluntarily. Thus the chairman of the admissions committee of one medical school told me that one year the student who had been ranked highest by their committee had quit school after only two weeks and gave as his reason that it was too much work. In another medical school this year five freshmen presumably accepted because of their superior grades, had dropped out before Thanksgiving. That is one thing that I have never seen happen to any Spring Hill student. I attribute it to the fact that our pre-medical students have been accustomed to "working under pressure," as Father Schwitalla at St. Louis used to express it.

Therefore, until the teachers in the medical schools gear their instruction to the level of these non-scientifically trained students, my advice to pre-medical students is to make sure that the "minimum" of science which they do take will really fit them to step into classes of anatomy, biochemistry, etc., *as they are taught now* in the medical schools. They can get some idea of what they are like by consulting with some of their confreres who are now undergoing the experience. However, they must also get good enough grades in these and other subjects so as not to be discriminated against by boards of admission because of low quality quotients. Finally, I would beg them not to be satisfied merely to "keep up" with the class in their non-scientific subjects, because many science majors have told me that they find some of these so easy in comparison with the sciences that they can get good grades in them without much study. As a consequence while they may get good grades, they do not really know the matter and this lack of knowledge in history, English, etc., will hurt them in both the Medical College Admission Test and the personal interviews which many medical schools are now requiring.

To the committees on admission of the medical schools I would also humbly submit that they take into consideration not only the grades of applicants but also the subjects in which they are gained, and the standards of the college where the studies were made. These last can be judged by the past record of the college's students in the medical schools.

FORELIMB REGENERATION IN THE SALAMANDER

Rufus P. Roberts, S.J.

Regeneration is the ability of an organism to repair or restore an injured or lost part from materials within itself. There are two main forms of regeneration: in one the lost structure is replaced by a re-organization of old materials already present in the organism; in the other the new structure is organized from new materials that are derived from the old part, or stump of the lost structure. Regeneration has been observed to some degree in every living organism, and the more complex are the structures of the organism, the less is its capability to regenerate. In the small invertebrates, whole new bodies can develop from a fragment; in the smaller vertebrates, limbs can be re-formed when lost; in the higher vertebrates and man, regeneration is very limited and only certain tissues can be re-formed.

Since this is true, histological studies of regeneration are conducted on the invertebrates and on the smaller vertebrates, such as the larvae of the frog and the adult salamander, *Triturus viridescens*. Regeneration resembles the embryological development of the lost structure by the formation of a blastema. A blastema, embryologically, is the primordium of an organ which will appear fully developed in the adult, and if the blastema in the embryo for a certain organ is destroyed, the adult will never develop that organ. In regeneration, the formation of a blastema has been observed, and, therefore, a blastema, when referred to the regenerative process, can be defined as the growing-point of the new limb, which forms at the point of amputation of the old limb and from which the materials are derived to develop the regenerate.

To determine the mechanisms of regeneration, a great number of experiments have been performed using the larvae of the frog, *Rana sylvatica*, and the adults of the salamander, *Triturus viridescens*. Since the method of investigation is basically the same for both animals and since the findings are generally identical, our review of the more recent work and discoveries on regeneration is limited to that done on *Triturus viridescens*, which is by far the more convenient laboratory animal to use, both because of the ease with which it is raised, and because of the facility of macroscopic and microscopic examination of the regenerative process in its limbs.

Studying the formation of the regeneration blastema on the forelimbs of *Triturus viridescens*, Doctor S. Meryl Rose of Smith College submits an interesting report, but her conclusion seems to want experimental verification. It had been demonstrated that the regeneration blastema must arise from local tissues in the vicinity of the point of amputation. Doctor Rose observed that, prior to blastema formation, no local tissue except the epidermis begins to increase by prolific cell division, and that during the pre-blastema period there is a continuous migration of epidermal cells to the distal tip of the

stump where a mound of epidermal tissues forms. When blastema formation takes place, Doctor Rose also reports that the number of epidermal cells decreases as the number of regenerative cells increases, and that the cells of no other tissue decrease as much during blastema formation. From these observations, she concludes that the disappearing epidermal cells dedifferentiate and are transformed into regenerative cells. In other words, the epidermal cells lose their specification as epidermal cells, and in becoming regenerative cells are again capable of being respecified as bone, muscle, or nerve tissue. This indifference to differentiation is a characteristic of germ cells alone, and if it were possible for specified cells to be dedifferentiated it would be required that germ cells be formed and be present. This is not true, as the germ cells are formed by and always remain in the gonads. Their exclusive function is the generation of a new organism, but not regeneration. Therefore, we must conclude that Doctor Rose's explanation is inadequate, though we must accept the observed facts she offers, namely: that epidermal cells after prolific cell division migrate to the distal point of amputation; that these cells decrease in number as regenerative cells increase. But her conclusion that the epidermal cells lose their specification and are re-formed into muscle or bone cells must not be accepted too readily, for other tissues are known to play an important part in regeneration and their role seems to have been omitted by Doctor Rose.

Over the past few years, a tremendous amount of work has been done by Doctor Marcus Singer of the Harvard Medical School on the nervous system and regeneration of the forelimbs of *Triturus viridescens*. Having established in a previous investigation the principle of the importance of the number of nerve fibres participating in regeneration of the upper arm, he has extended this principle to the other regions of the forelimb. The requirement of a definite quantity, expressed as a threshold range of nerve fibres above which regeneration always takes place and below which regeneration will never occur appears for each level of the limb. Each of the spinal nerves which supply the forelimb participates in regeneration, but the extent of their individual participation depends on their fibre content. Though the nerve requirements of the respective levels of the limb differ, they bear no relation to one another. Because the forearm requires the greatest number of nerve fibres and the digits require the least, Doctor Singer advances the theory that the number of nerves required for limb regeneration is determined by the amount of tissue at the amputation surface. To establish this theory, he carried on further investigation and was able to demonstrate that the nerve requirements can be expressed in terms of the size of the surface of amputation. It was observed that the number of nerves required per unit area of surface is quite constant for the regions of the forelimb even though they are widely separated, such as the digits and the arm. He, therefore, concluded that the number of nerves present

in the area of regeneration is determined by the tissues submitted to regeneration by amputation and not by the nerves themselves. The hand, alone, unlike the other regions was found not to obey the constant of fibres per unit area established for all other regions, but was found to be more responsive to the nerve influence, requiring less than half of the fibres per unit area needed elsewhere.

To confirm this all-important part played by the quantity of nerve fibres at the surface of regeneration in a negative way, Doctor Singer subsequently reports the results of experiments in which, by interference, he limited the number of required nerve fibres so that the number was less than that normally available at the point of regeneration. Though the onset of regeneration in these animals was found in most instances to be as rapid as in normal ones, the successive stages of the process were observed to be slower, and the end result was a regenerated limb which was deficient both in length and in volume, but mostly in volume. Widely different nerve quantities, when still capable of initiating regeneration, yielded regenerates with disturbances to a similar degree so that the dependence of the process of normal regeneration on the number of fibres present at the site of amputation is established as certain.

In conclusion, Doctor Singer submits a very enlightening report on the invasion of the epidermis of the regenerating forelimb of *Triturus viridescens* by nerve fibres. These fibres invade the epidermis of the regenerating forelimb in numbers which far exceed those found in normal skin. The fibres are naked and unaccompanied by Schwann cells. They enter the epidermis singly or in fascicles and grow freely in every direction, and for great distances. In general, the number of these fibres is much smaller in the proximal part of the forelimb than at the distal stump where regeneration is occurring. Therefore, the mechanism of regeneration, though for the most part it is still a mystery, seems to depend very much on the presence of nerve cells; and in the regenerative process the relation between the nerve and the epidermis is very important.

Summary

1. The mechanism of regeneration has been studied in the forelimb of *Triturus viridescens*.
2. Epidermal cells are observed to proliferate and are thought to dedifferentiate in blastema formation. This theory is criticized as it seems to omit the important role of the nerve fibres.
3. The regenerative process, both initially and throughout its duration, is seen to depend on the quantity of nerve fibres present at the surface of amputation. The number of nerve fibres required can be expressed as a constant per unit area of amputated surface.
4. Nerve fibres are observed to invade the epidermis of the distal portion of the regenerating limb in far greater numbers than in normal epidermis.

5. All the work so far has been concerned with the manner in which regeneration takes place; what actually happens has been observed and is reported. In the Biology Laboratory at Weston, further work is now being done on regeneration of the forelimb of *Triturus viridescens*, but the purpose is not only to observe what happens but to establish why it happens as it does. This question is an important one and is avoided by most investigators who seem to think that all the phenomena of living organisms can be explained on a purely materialistic level. They devote themselves to finding out what happens and consider such knowledge adequate. They fail to consider the "why" of the phenomena they observe. But without this knowledge the scope of their learning and achievement must forever be limited by things material.

References

Rose, S. Meryl, J. Exp. Zool., *108*, no. 3, August, 1948.
Singer, Marcus, J. Exp. Zool., *104*, no. 2, March, 1947.
Singer, Marcus, J. Exp. Zool., *111*, no. 2, July, 1949.

Chemistry

A SIMPLE DEMONSTRATION OF THE COLLOIDAL AND CRYSTALLINE STATE OF THE SAME SUBSTANCE

Abstract

Rev. Albert F. McGuinn, S.J.

Silver chloride is precipitated and found to be colloidal. It is then further coagulated and washed by decantation. This is followed by washing in strong ammonia. When the ammonia is removed by evaporation, microscopic examination reveals that crystalline silver chloride has been formed. The demonstration can be used as an occasion for the discussion of complex ion equilibrium, the theory of colloid formation and the theory of crystallization with applications to quantitative analysis.

THE VITREOUS STATE

Abstract

Rev. Joseph J. Sullivan, S.J.

The vitreous state is natural to a few compounds. For most substances, the crystalline is the usual solid state. These substances, the majority, have a definite melting point, and a definite boiling point leading to the vapor phase. As the ordinary substance above the boil-

ing point is cooled, it reaches the liquefaction temperature. As it is further cooled, it reaches the point of solidification (M. P. or F. P.) and it solidifies as a crystal, according to the Laws of Crystallization.

The few other substances, like silicon dioxide (quartz) and the complex silicates of sodium, calcium, magnesium, boron, etc., usually form the vitreous solids.

Now from the kinetic theory, we know that the motion of liquid molecules is haphazard. However, during ordinary cooling (i.e. not necessarily hurried), this motion slows down, and near the freezing point, normal molecules tend to take up specified positions in a determined lattice, following specific Van der Waal's forces. On continued cooling, this will result in crystallization.

But, if a substance in the liquid state is cooled very rapidly—i.e. with a temperature differential of two hundred degrees or more—the haphazard condition of the liquid state is maintained in the solid state. And so we have a supercooled liquid or a glass.

The late Professor Tamann of the California Institute of Technology, vitrified over one hundred and fifty compounds. The most difficult, water, has also been obtained in the vitreous state. This is the goal of deep-freezing processes of today—fast freezing, to avoid sharp-edged crystals.

To reverse the process for a vitreous solid. On being heated, it will not be found to have a definite melting point. It reaches the so-called "flowing-point". However, if the temperature is maintained about fifteen degrees below what would be the melting point of its crystalline form, it slowly crystallizes. That is why glass-workers do a job "once and for all" and leave it. For on long working, the glass "deteriorates", as they say, or crystallizes.

A SYSTEM OF STOICHIOMETRY

Abstract

Rev. Bernard A. Fiekers, S.J.

The equation $V\ C = v_1c_1 + v_2c_2 +$ etc. was proposed as a fundamental dilution equation in which other concentration terms can be substituted and added terms to the right dropped when solvent is used for dilution. As a reaction equation both algebraic sign and stoichiometrical coefficients have to be taken into account. Various particular applications were made. The graphical method of mixing by employing *alligation alternate* was justified in the algebraic rearrangement of the equation given, together with an equation for the summation of volumes. Gravity changes were discussed. See This Bulletin, *27*, 62 (1950).

HOMEMADE PHOTOGRAPHIC COPYING APPARATUS

Abstract

Rev. Joseph A. Martus, S.J.

A homemade apparatus to be used in photographic copying was described, consisting of two vertical supports of strap steel for photo-flood lights, at each end of a small table, and a U-frame made of angle iron, supported in the middle of the table. The U-frame can be raised or lowered and at the centre of the horizontal piece of this frame is attached a gear and rack device on a small wooden board, for raising and lowering the attached camera. The essential note of the set-up is economy, as most of the parts, with the exception of one or two small pieces, were *bona derelicta*.

GRAVITY FILTRATION IN THE PREPARATION OF $KMnO_4$

Abstract

George A. Duffy, S.J.

The ordinary method of preparing a permanganate solution for quantitative analysis work, which is used in many of our schools, is to dissolve the crystals in water, boil for 15 minutes, allow to stand overnight, and then filter through a Gooch crucible. In Treadwell & Hall,[1] however, a different method is suggested. Put a small piece of glass wool in an ordinary glass funnel and pour an asbestos suspension over it. With such a filter no suction is needed. It is noted in the book that such a procedure is preferable since there is no possibility of the solution coming in contact with rubber, resulting in the formation of MnO_2 and an unstable solution.

Another objection to the Gooch method presents itself, which, although mercenary, is quite practical. The use of a Gooch filter calls for an aspirator and suction flask both of which are fairly expensive and can be broken. The method mentioned in Treadwell & Hall calls for less equipment, less expensive equipment, and equipment less likely to be broken. The time difference between the two methods is negligible.

THE EFFECT OF A WETTING AGENT ON SURFACE TENSION

J. Albert Chatard, S.J. and Robert E. Varnerin, S.J.

The following experiment was undertaken primarily to study one of the fundamental applications of tensiometric measurements and secondarily to satisfy a curiosity on why a wetting agent acts as a cleansing substance. The term "detergent" and "wetting agent" have

[1]Treadwell, F. P. and Hall, W. T., "Analytic Chemistry," Vol. II, 9th ed., Wiley, N. Y., 1942.

become very important in the past few years. Though developed in the late 1920's, they remained a laboratory curiosity with little commercial value until the last war. At that time, much of our arms and ammunition had to be packed with a protective coating of grease for overseas shipment. The Army and Navy needed an efficient cleanser to cut this grease and have the materials ready on short notice. As a result, the synthetic detergent industry developed "soaps" that would perform efficiently under almost any condition.

Basically the function of the detergent is to remove the dirt with a minimum of effort and labor. As the reader already knows, dirt and grease contain not only water soluble matter but insoluble oil as well. The water soluble matter offers no problem in cleaning. However, to remove the oily matter, the water must first wet the surface of the particles and then carry them into the cleansing solution as a suspension. To accomplish this, the detergent must penetrate the interface existing between the oil particles and the surface to which they adhere. Penetration of this interface is possible if the surface tension of the cleansing solution is sufficiently reduced. The resultant reduction permits the individual molecules of the cleansing agent to penetrate the surface film of the oily micelles. This penetration causes a wetting action on the grease particles and a resultant lowering of the interfacial tension between the grease and the adhesion surface. Eventually the attractive force is broken and the grease is forced into the liquid by mechanical means such as scrubbing and rinsing. The emulsifying power of the detergent then keeps the particles in suspension.

There are other properties such as non-toxidity and relative chemical inertness which a detergent should possess. In addition, the wetting agent must show great resistance to the acid content of ordinary dirt and grease. It should be only slightly effected by the dissolved salts in hard water. Both of these factors influence the effective lowering of the surface tension. However, the reaction of these factors on a detergent is far less than on ordinary soap. For a fuller discussion of the theory and properties of detergents the reader is referred to an article entitled "Synthetic Detergents and Surface Activity" by Cornelia Snell (1).

An experiment demonstrating the surface activity of a wetting agent was suggested as a result of an article appearing in the Cenco Bulletin (2). According to the author, the tensiometer is not only an accurate instrument for the measurement of absolute surface tension, but also for the determination of a rate of change in surface tension. The capillary method can be applied to the same problem and gives extreme accuracy but it is tedious and consumes considerable time. The ease and rapidity of tensiometric measurement makes the tensiometer better adapted to problems requiring large numbers of determinations. As a result, the tensiometer, for a rate of change measurement, is a valuable instrument in the hands of the industrial physical chemist.

It was hoped that this application of the tensiometric analysis could be accomplished by studying the effective lowering of the surface tension of water by increasing the concentration of a dissolved substance. Such an experiment could not be found in any available laboratory manual. The manuals gave instructions for studying the effect of temperature on surface tension, but none involving concentration. As a result the following experiment was devised.

Procedure:

The tensiometer was calibrated in the usual manner (as prescribed by the Cenco Bulletin (3) quoted above) and two liquids of known surface tension (Glycerol and Acetone) were used to check the calibration curve. The results were sufficiently accurate to use the curve for the purposes of this experiment.

The substance chosen as the surface active agent for this experiment was the laboratory cleansing powder, Alconox. It was chosen because the manufacturer claims its cleansing power is due to its wetting activity. The directions with the detergent prescribe 1 to 1.5 ounces per gallon for most effective results. The purpose of the experiment was to determine why the company advised this particular concentration. The results proved rather interesting.

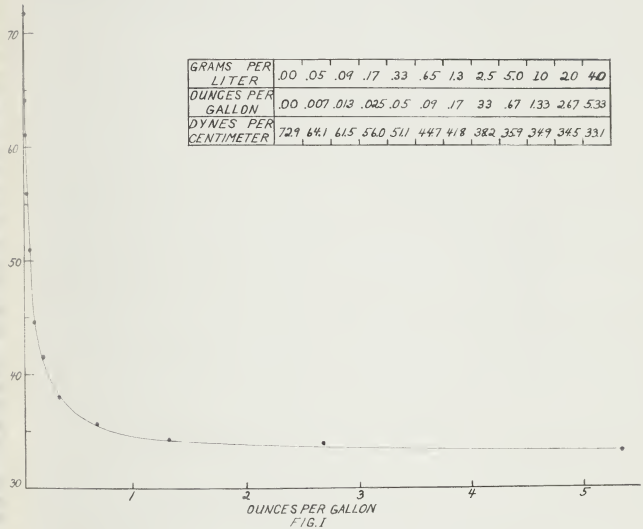
The first determination was made with a saturated solution of the cleansing agent using 5.33 ounces per gallon (40 grams per liter). Each successive determination was a 50% dilution of the previous one. Distilled water was used in all dilutions and the temperature was kept at 20° to 25°C. The results are shown in figure I.

As can be seen from figure I, the change in surface tension is moderately large with the addition of very little wetting agent. As little as 0.013 ounces per gallon effectively reduces the surface tension approximately 11 dynes per centimeter. The decrease continues until about one ounce per gallon is reached. Following this, the curve levels out. Any addition would be practically ineffective.

This data corresponds favorably with that offered by Snell (1). In the course of the article, the author states that efficient wetting agents reduce the surface tension from 72 dynes per centimeter for pure water to a range of 25 to 35 dynes per centimeter for a solution of the surface active agent. Fig. I indicates that a saturated solution of the wetting agent employed in this experiment reduces the effective surface tension to 33 dynes per centimeter. The concentration of the greatest efficiency advised by the manufacturer, was found to lower the surface tension to about 35 dynes per centimeter.

A closer analysis of the curve gives the following information: After the 0.5 ounce per gallon concentration is attained, the rate of increasing concentration begins to exceed the rate of decreasing surface tension. It would seem that this should be the most economical concentration. However, the company advises further addition of 0.5 ounces per gallon. This can be explained from the fact that the effective lowering of the surface tension is still considerable until

the point 0.9 ounces per gallon is reached. The slight excess above this concentration is added to give maximum efficiency under hard or oily water conditions. Any concentration in excess of 1 ounce per gallon should be used only in extreme cases as its effect on surface tension is very slight.



GRAMS PER LITER	.00	.05	.09	.17	.33	.65	1.3	2.5	5.0	10	20	40
OUNCES PER GALLON	.00	.007	.013	.025	.05	.09	.17	.33	.67	1.33	2.67	5.33
DYNES PER CENTIMETER	72.9	64.1	61.5	56.0	51.1	44.7	41.8	38.2	35.9	34.9	34.5	33.1

FIG. I

There is no claim for absolute accuracy in the data of this experiment. The various measurements differed as much as 2% from one series of determinations to another. The table in figure I is an average of a number of independent determinations.

Among the advantages derived from this experiment was the application of the tensiometer to a very important operation in industry. From the recent American Chemical Society publications the reader is able to see the many problems using this type of measurement. In addition, the results showed rather clearly one of the main properties of a wetting agent. This study clarified many of the fundamental concepts dealing with surface tension met in the elementary physical chemistry course.

References

1. Snell, Cornelia T., *Synthetic Detergents and Surface Activity*, J. Chem. Educ., *24*, (1947) page 505 to 511.
2. Cenco Bulletin, *Surface and Interfacial Tensions by the Ring Method*, Bulletin No. 101, page 4.
3. Cenco Bulletin No. 101, Supplementary Notes, *Operation and Determination of Apparent Surface Tension*, page 1.

THEORIES OF ACIDS AND BASES, PROPOSED SYMPOSIUM

Rev. Gerald F. Hutchinson, S.J.
Chairman for the Symposium

At the September 1949 meeting of the Chemistry Section of the ASSOCIATION it was felt that future meetings of the section would be more profitable to all the members of the section if a symposium program could be laid out in advance. Various topics for symposia were discussed such as the teaching of oxidation-reduction, chemical equilibrium, the kinetic-molecular hypothesis, kinetic theory of gases and the like. It was decided to discuss theories of acids and bases, since this is usually a most vexing problem to the teacher, and it could still be used to inaugurate a series of such symposia by picking up the pre-war thread in the selection and review of a topic that had been treated at the Holy Cross meeting in 1941. Father Hutchinson was appointed chairman of the symposium and other speakers were chosen according to the tentative program outlined below.

Introduction

General Review of the Theories of Acids and Bases
Rev. Joseph J. Sullivan, S.J.,
Weston College

The Electronic Theory of Acids and Bases
Rev. James J. Pallace, S.J.,
Canisius College

What Should be Taught in First Chemistry?
Rev. Gerald F. Hutchinson, S.J.,
Fairfield University

Some Demonstrations in Acid-Base Theory
Rev. Bernard A. Fiekers, S.J.,
College of the Holy Cross

It is hoped that this symposium will not deter the chemists from presenting other topics in the meeting of the section; indeed, all chemists are invited to prepare a paper on this symposium or on any other chemical topic for the meeting, or in lieu of that to read up on the proposed material, so as to be ready to take an active part in the dis-

cussion. It would be appreciated if others would get into the program, by taking up some aspect that does not appear above, but which is suggested by Father Sullivan's outline in the following article. Send in the title of your talk to Father George J. Hilsdorf, S.J., St. Peter's College, Jersey City, N. J. Father Hilsdorf is chairman of the Chemistry Section and will make out the program for the August or September meeting of the section.

OUTLINE OF THE SYMPOSIUM ON ACIDS AND BASES

Rev. Joseph J. Sullivan, S.J.*

From the beginning of their history, acids and bases have been considered opposites. So, if an acid is defined, a base is thereby described. Up to 1939 five different theories of acids and bases were proposed. These do not include the "oxygen-theory" of Lavoisier.

1. Arrhenius (1887) (1). This is the water-ion theory. The acid, here in water, may be considered a proton-donor. e. g.

$$H_2SO_4 \rightleftharpoons 2H^+ + SO_4^=$$

2. The solvo-theory, sponsored by Franklin (2) (1924), Bjerrum (3), Walden (4) and Janden (5) and latterly extended by Germann (6). Here, an acid does not necessarily supply a proton, but a cation. e. g.

$$2NH_3 \rightleftharpoons NH_4^+ + NH_2^-$$
$$2SO_2 \rightleftharpoons SO^{++} + SO_3^=$$
$$COCl_2 \rightleftharpoons CO^{++} + 2Cl^-$$

3. Bronsted (7), Lowry (8), (1923), called by G. N. Lewis "The Cult of the Proton". Here an acid is a proton-giver.

$$HCl + H_2O \rightleftharpoons H_3O^+ + Cl^-$$
$$NH_4 + H_2O \rightleftharpoons H_3O^+ + NH_3^-$$

N. B. A good treatment of catalytic activity in "prototropic systems" is given by Hammett (9).

4. G. N. Lewis (10) (1923), "the electron-pair theory". Here an acid is an acceptor of an electron pair. Neutralization is the formation of the coordinate bond. e. g.

$$H^+ + :\overset{\cdot\cdot}{C}::N:^- \rightarrow H:C::\overset{\cdot\cdot}{N}:$$

Acid Base Formation of coordinate bond.

This system was developed by Sidgwick (11) (1927).

5. M. Usanovich (12). The "Positive-negative system", broader still than the Lewis picture. An acid is electropositive or electrophilic. A base is nucleophilic. e. g.

$$Na_2O + SO_3 \rightarrow 2Na^+ + SO_4^=$$

* Sullivan, Bulletin, A. A. J. S. *19*, 26 (1941)

Here Na_2O is a base because it gives up the anion $O^=$, and SO_3 is an acid because it takes it up.

A good resume of theories 1), 3), and 4) is given by Luder (13) Cf. also (14), (15).

BIBLIOGRAPHY

1. Arrhenius, Z. phys. Chem. *1*, 481 (1887)
2. Franklin, J. Am. Chem. Soc., *46*, 2137 (1924)
3. Bjerrum, Chem. Reviews, *16*, 287 (1935)
4. Walden, "Salts, Acids and Bases", McGraw-Hill, New York, 1929
5. Jander, Z. phys. Chem., *178*, 57 (1936)
6. Germann, J. Am. Chem. Soc., *47*, 246 (1925)
7. Bronsted, Rec. trav. chim., *42*, 718 (1923); also Chem. Rev. 5, 231 (1928)
8. Lowry, Chem. and Ind., *42*, 43 (1923)
9. Hammett, Chem. Rev. *13*, 61 (1933)
10. Lewis, "Valence and the Structure of Atoms and Molecules", Chemical Catalog Co., New York, 1923. Also, J. Franklin Inst. *226*, 293-313 (1938) J. Am. Chem. Soc., *61*, 1886, 1894 (1939).
11. Sidgwick, "The Electronic Theory of Valency", Oxford U. Press, N. Y., 1927
12. Usanovich, J. Gen. Chem. (U. S. S. R.) *9*, 182 (1939)
13. Luder, J. Chem. Educ. *25*, 555 (1948). Also Luder and Zuffanti, "The Electronic Theory of Acids and Bases", John Wiley and Sons, New York, 1946
14. Acids and Bases. A collection of eight papers, published by J. Chem. Educ., copyright 1941
15. Bibliography by Alyea, J. Chem. Educ., *16*, 535 (1939)

THE ELECTRONIC THEORY OF ACIDS AND BASES

REV. JAMES J. PALLACE, S.J.

In the electronic theory of acids and bases Lewis chose four experimental criteria as the basis of his definitions of acids and bases: (1) neutralization, (2) titration with indicators, (3) displacement, (4) catalysis. Neutralization is the formation of the coordinate covalent bond between the acid and the base. The base donates a share in a lone pair of electrons to the acid to form the coordinate covalent bond between the two.

TEACHING ACID-BASE THEORY IN FIRST YEAR COLLEGE CHEMISTRY

REV. GERALD F. HUTCHINSON, S.J.

The guiding principles governing the amount of acid-base theory that should be taught in first year College chemistry are the same as

those which guide chemistry teaching in general. Sufficient should be taught to leave the student with satisfying completeness in the matter he has been taught, a solid foundation should be laid for his work in proximately succeeding courses, and the general educative value of understanding the following of theory after better substantiated theory, even when it leads into present greater obscurity and difficulty of comprehension. In accordance with these principles, in the author's opinion, the student should be first grounded solidly in the Arrhenius theory and terminology both as a basis for understanding more modern theories and for his work in analysis. Then the theory of complete ionization of salts with the Debye-Huckel explanation should be given. The difference in structure and consequent difference in behavior upon solution in water of salts and acids should be explained. The Bronsted theory of protolysis and its definitions of acids and bases completes this picture for the Freshman's interest and capacity.

DEMONSTRATIONS IN ACID BASE THEORY

Rev. Bernard A. Fiekers, S.J.

It is the author's opinion that most chemists will agree that acids and bases will generally change the colors of indicators, but would hesitate to define them on this criterion because of its great breadth of concept and the impracticability involved. Many chemists would allow such a definition under the conditions that an electro-conducting system is involved and that certain theoretical and practical advantages are offered. Thus they might speak of NaOH as an Arrhenius base and a Bronsted salt; of OH^- and Ac^- as Bronsted bases; of NH_3 as a Bronsted and a Lewis base; and of BF_3 as a Lewis acid.

The author hopes to devise some demonstrations along the lines of these principles, repeating perhaps some given by Father Sullivan at Holy Cross in 1941, and adding possibly some conductivity demonstrations provided that low dielectric systems can be kept dry and conveniently transported to the site of the meeting.

OLD LITMUS PAPER VIALS

Rev. Gerard M. Landrey, S.J.

In view of the rising cost of laboratory glassware the following may prove helpful in converting litmus paper vials into graduated cylinders of 9 or 10 cc. capacity. Take a group of vials of like diameter, and in one vial determine the height in millimeters occupied by 1 cc. of water. It will be about 5 or 6 millimeters. Take a piece of heavy gummed paper used in mailing packages and draw horizontal lines the required distance apart. Through these lines draw vertical lines 3 or 4 millimeters apart. On each segment just above the graduate lines mark 1,2,3, etc. Cut along the vertical lines, paste the strips on the vials, and seal with label varnish. The author

prepared two dozen graduated cylinders in a half hour. These graduates do not have flanged bases, but being much shorter than the usual 10 cc. graduates, they have good stability. The accuracy of graduation is quite sufficient for ordinary laboratory use.

Physics

THE COOPERATIVE PHYSICS TESTS AT GEORGETOWN

Abstract

Rev. Joseph F. Cohalan, S.J.

Brief discussion of the multiple choice tests issued by the Cooperative Test Service. Points discussed included the type of test; method of administration; median, average, standard deviation, quartile and decile grades, some points concerning national norms. The suggestion was made that the tests be used by the colleges of the three provinces and the results compared at the next meeting of the Association.

SIZE, DISTANCE, SHAPE AND COLOR IN PSYCHOPHYSICS

Abstract

Rev. John A. Tobin, S.J.

When we look at some natural scene, as an airport, we see certain objects spread out in a definite arrangement in space. How do we explain how we see an airplaine of definite size, shape and color at some distance? The abrupt changes in light that reach our eyes, give us the boundaries of the objects, and if we know the shapes from past experience we have the perception of the plane. If we know the distance to the plane, we know the size from the image on the retina and the visual angle. If we know the size then we can judge the distance to that object. If it is a luminous body it sends out definite wave lengths to the eye and it produces the sensation of color. If we have white light, then opaque objects absorb some wavelengths and reflect a definite wavelength to the eye. If the body is translucent it absorbs and transmits definite wavelengths to the eye. The bodies refract and disperse the wavelengths, or diffract the white light and by interference permit definite wavelengths, or scatter and polarize the light and send definite wavelengths. Color then is a potency in the body to send certain wavelengths that are perceived by the eye and produce the sensation we call color. We do not see the waves except by means of this

radiant energy. We are conscious that we see real objects in a real world. Form vision and color vision are more than the object's sending energy to reach the eye and then the brain. We interpret the stimuli in the light of past experience. Until we have an awareness of the stimuli and refer them back to the object that sent the energy, we do not have color as perceived. Three sciences are required in the explanation. In physics we study the cause of the energy and the means by which it reaches the eye. We can measure the magnitude, direction and wavelength, before it reaches the eye. Physiology starts where physics stops—when energy reaches the eye. The functions of the eye, nerves and brain can be measured, but not so easily explained. The use of thermocouples, galvanometers, amplifiers and oscilloscopes in these measurements requires some knowledge of the theory of these physical instruments. The awareness of the stimuli and the perception of form and color depends also on our unconscious past experience or some innate organized forces in the brain, so a third branch of science is required that can explain how we assimulate the concrete and physical phenomena to abstract principles. Psychology explains the sensation and consciousness of color and form of objects. Size constancy and color constancy, simultaneous color contrasts, after image, etc. and past experience from our highly trained vision are needed to explain how we perceive these objects of definite form and color. Psychophysics is the union of physics, physiology and psychology. All three are needed to explain how we see the airplane of definite size and shape, color and distance.

SOME COUPLED SYSTEMS IN PHYSICS

Abstract

In classical physics if n identical oscillators are coupled in series there appear n different frequencies corresponding to n modes of vibration of the coupled systems. This may be illustrated with chains of masses connected by springs or by filter circuits. Complicated cases of such systems occur in molecules and crystals.

These classical notions may be transferred to quantum theory with the help of the relation $\Delta E = h\nu$. One may then explain the spectra of atoms in terms of coupled hydrogen-like wave functions. Considerations of symmetry account for the fact that energy is independent of the magnetic quantum number in the first approximation. This degeneracy is removed by spin-orbit coupling.

Robert O. Brennan, S.J.

COLOR AND THE STRUCTURE OF ORGANIC MOLECULES

Abstract

JOSEPH F. MULLIGAN, S.J.

Color is due to selective absorption of incident light by the molecules of a substance. The frequency at which absorption occurs is given by $\nu_c = (E_i - E_f)/h$, where E_i and E_f are the energies of the initial and final electronic states of the molecule, and h is Planck's constant. Most stable substances have large energy differences $E_i - E_f$ and so absorb only in the ultraviolet. They are therefore colorless. However, there are certain organic molecules which absorb in the visible. These possess chains of carbon atoms with conjugated double bonds. The quantum mechanical theory of molecular orbitals shows that the p_z or non-localized electrons, that form the π part of the double bonds, are the cause of this shifting of the absorption region into the visible. These electrons initially have the same energy in the separated carbon atoms. In the molecule they are coupled together, and this produces a splitting of the energy levels of the molecule, just as the coupling of mechanical oscillators of the same frequency produces a splitting of frequencies. The more p_z electrons that are coupled together, the greater the number of resulting energy levels and the closer they lie together. Transitions between these close-lying levels cause absorption in the visible and the color of substances containing these molecules. As more and more atoms containing conjugated double bonds are added to a chain, the absorption limit moves from the violet towards the red end of the spectrum. The extreme is reached with such substances as graphite. Here the absorption covers the whole visible spectrum, and graphite is a black substance of high opacity. This same idea of coupling in molecules well explains the properties of metals.

FATHER SECCHI S.J. AND STELLAR SPECTRA

Abstract

MARTIN F. MCCARTHY, S.J.

This paper gives an historical sketch of the work accomplished by Father Angelo Secchi of the Society of Jesus in the field of stellar spectroscopy. After a brief summary of the outstanding features of this pioneer astrophysicist's life, an evaluation of his contributions to the knowledge and classification of stellar spectra is presented. First, the influence of previous researches upon Fr. Secchi's system is outlined; there follows a description of the instruments he employed in his observations; next, the development of the Secchi method of classification is traced in detail; finally, certain of the prominent features and astrophysical *by-products* of this classification are delineated. From an examination of the original papers contributed by Fr. Secchi to *Comptes Rendus* and to *Memorie delle Societe Italiana*

delle Scienze, the conclusion is drawn that although Fr. Secchi did not make his classification of spectral types according to any fixed scheme of stellar evolution, still his work foreshadowed in very large part what is well-known to astrophysicists today as the *main sequence and its branches. Editor's Note.*—This paper was presented at the close of the second general meeting of the ASSOCIATION.

Mathematics

A TRANSPOSITION OF THE PLANE WHICH LEAVES ALL PLANE FIGURES UNALTERED IN SHAPE

Abstract

REV. EDWARD C. PHILLIPS, S.J.

This paper started with the equation for a straight line in Cartesian co-ordinates. The equation was transferred to the normal form—called the *perpendicular form* by some authors—namely

$$(\cos w)\ x + (\sin w)\ y - p = 0 \qquad (1)$$

The general line of change is, in the normal form

$$(\cos a)\ x + (\sin a)\ y - p, 0 \qquad (2)$$

Multiplying the first form by the co-efficients of the second form, we twist each figure through the angle a and increase the distance from the centre of expansion by the quantity p_1. As the angle a and the increase in distance from the centre, i.e., the point (0, 0), are the same in all equations for the straight lines of the plane figures, these are changed only in size and position, but not in shape. The new line is given by

$$(\cos w + a)\ x + (\sin w + a)\ y - pp_1 = 0 \quad (3)$$

If we put in any arbitrary constant, λ, we get any possible change:

$$(\cos w + \lambda a)\ x + (\sin w + \lambda a)\ y - \lambda\, p_1 p = 0\ (4)$$

If we make λ change continuously like a variable, we get all possible lines representing the old and original line (1), which leave all plane figures in the plane altered only as to position and size but not in shape.

NOTES ON DIMENSIONAL ANALYSIS

Abstract

Rev. Stanley Bezuszka, S.J.

Frequently the work on Dimensional Analysis is restricted to methods of checking equations or answers to given problems. Since this is but a minor and rather insignificant application of the general Dimensional Theory, other uses of Dimensional Analysis were explained and the source of a modern approach to Dimensional Analysis indicated. In this new method, dimensional theory is applied to

a. designation of concepts
b. derivation of equations
c. model theory
d. change of units
e. transformation of axes

In addition to a historical introduction, the present set of notes on Dimensional Analysis includes a chapter of explanatory text, problems and eleven Tables of concepts (from the main branches of physics) in their Base Vector form. *Editor's Note.* This paper has been published in full in This Bulletin, *27,* 18-22 (1949). Reprints, as well as a copy of the essential steps in the methods of idon analysis with prepared tables of variables expressed in the fundamental concepts are available in *limited* quantity on request to the author: 92 Hope St., Providence, R. I.

History of Jesuit Science

THE JESUITS IN CHINA: THEIR SCIENTIFIC WORK

SIR FREDERICK MAZE, K. C. M. G., K. B. E.*

The first historical record of the introduction of Christianity into China is a stone slab known as the Nestorian Tablet, dated 781. It was discovered in the year 1625 near the capital of the Shensi Province, Sian-fu, a district in North China which is rich with the remnants of ancient civilisation. The Nestorians[1] were at first favourably received, but as time progressed the tide of Chinese official favour turned against them, and an Edict of the Emperor Wu-tsung of the T'ang Dynasty (A. D. 620-907), banished them in 845. It should be mentioned however, that Marco Polo, the Venetian traveller, has stated that a few of their congregations still existed about the close of the 13th century when he was in the East.

The Society of Jesus began its remarkable work in China towards the end of the 16th century. St. Francis Xavier was the first member of the Order who attempted to enter the country. He fell ill *en route* and died on an island off the South coast in 1552. Shortly afterwards he was followed by Father Matthew Ricci, the first Jesuit who settled on the Mainland. His headquarters were originally established in Kwangtung (the Canton Province), and in course of a few years' time he journeyed to Nanch'ang, the capital of the Kiangsi Province on the Yangtze. At a later period he proceeded downstream to Nanking where unfavourable local conditions frustrated his missionary work. In these circumstances he decided to move on to Peking, then the capital of the Empire. He arrived there in the year 1601, friendless and unknown. Owing principally to his scientific attainments and forceful personality he won the confidence and esteem of the *literati*, some of whom became his

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* The publication of this article in the BULLETIN provides an exception to our general editorial policy of contributions by Jesuit authors only. The BULLETIN is indeed fortunate to be able to publish such a scholarly article by a distinguished and eminent author on a timely subject that is dear to the heart of every Jesuit. *Editor.*

[1] The Nestorians are supposed to have appeared in China about the beginning of the 7th century, and the only record of their evangelistic work in the Far East is the summary of their activities described on the Tablet referred to above. This is the interesting monument of bygone times is said to be the most ancient Christian inscription yet found on the continent of Asia. Its contents have been described as Doctrinal, Historical and Eulogistic, and it is recorded thereon that a Nestorian priest was received in the Palace by the Emperor in 635. *Vide* Footnote (3) *re* the Mohammedans.

converts, notably a famous Han-lin[2] scholar named Shü Kuang-chi who proved an influential supporter and valuable friend. Father Ricci's fame ultimately attracted the notice of the Emperor Wan-li (1573-1620). It is recorded that when he died the Emperor himself provided a sepulchre, and that a large number of the literary class attended his obsequies. His successor in Peking was Father Adam Schall von Bell, who likewise succeeded in gaining Imperial recognition. Through his personal influence an Imperial decree was promulgated providing for religious freedom. He was subsequently appointed to the high office of President of the Board of Astronomy. Father Verbiest was invited by him to come to the capital and co-operate in the scientific work in progress there under his direction. In the course of time he, too, succeeded in meriting the notice of one of the most famous Princes of the late Dynasty, K'ang-hsi; and he cultivated friendly relations with officials and others. Like his predecessor, Father von Bell, he was ultimately appointed President of the Board of Astronomy. When he died the Board of Rites prescribed the honours which were considered due to his memory and he was given a State funeral. It is interesting to note that these two distinguished *savants* are the only known examples of foreigners in China attaining executive Cabinet-rank in the Government of that country.[3] At a later period, however, the Brevet-title of President of a Board (Cabinet Minister) was conferred upon Sir Robert Hart.

In those early days of outside intercourse with China the Jesuits were the first Europeans to reveal detailed information of the manners and customs of the people, if we except the earlier narratives of Marco Polo. As Voltaire remarked of them, the general knowledge which they disclosed represented the production of the most intelligent travellers that extended and embellished the fields of science and philosophy in distant and little-known lands. It should further be observed that in addition to their evangelistic activities, their practical assistance to the Government in respect of the revision of the calendar and the production of maps, etc., was favourably recognised in Court circles, as evidenced by the Imperial favours conferred upon them. Their geographical work in China about this time has been described as the most complete of its kind executed out of Europe; and the maps of various localities prepared by them

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[2] The Han-lin Yuan (or College of Literature) exercised supervision over the educational requirements of the nation until it was superseded by the Board of Education in modern times. It was formerly charged with the preparation and custody of the Archives of the Dynasty of the day. Many irreplaceable historical records were destroyed therein during the Boxer upheaval in 1900.

[3] It may incidentally be mentioned here that the Mohammedans came to China in the 9th century, originally as traders. They introduced Western science and arts. It is understood that an Observatory in Peking was established by them about the year 1272, which apparently was still in existence in 1622 when Father Schall von Bell was made President of the Board of Astronomy or Mathematics, as stated above.

in the 17th century remain to this day notable examples of careful study and accurate research.

The Christian missionary position in China received a setback in the 18th century, and the propagation of the Gospel ceased for a time. The Society of Jesus was suppressed and did not return to the scenes of its past achievements until the middle of the following century. In the meantime political developments had materially altered conditions in the Far East. The Treaty of Nanking (1842), signed on board the British Flagship "Cornwallis", for example, marked the establishment of Treaty relations between China and the Western Powers,[4] and provided for the formal opening of the ports of Shanghai, Ningpo, Foochow, Amoy and Canton to foreign trade and shipping. A few years later, other Powers negotiated Treaties with China on more or less similar lines and the number of Treaty-ports was increased to sixteen.

Shanghai enjoys an unusually favourable situation near the mouth of the Yangtze, one of the largest navigable rivers in the world, which has a hinterland of some 75,000 square miles and serves a population of about 200,000,000 people inhabiting the fertile Yangtze Valley. No other port, it has been declared, possesses as potential a field of supply and demand. It has since become the leading shipping and commercial entrepôt on the continent of Asia. What of the future? In the long and romantic history of China we read of recurring wars and rumours of wars down the ages. The Chinese have an adage in this connection: "United long, divides; divided long, unites." Remembering this, it is reasonable to expect that when the existing political turmoil is finally adjusted, Shanghai will regain its former commercial pre-eminence in the Far East. It is obvious, of course, that its comparatively recent advance into the front rank of the ports of the world, is due mainly to foreign enterprise; and that the improvement of the Harbour and the approaches thereto is attributable to the skilful dispositions of the quasi-foreign controlled Whangpoo Conservancy Board.

When the Jesuits resumed their activities in China, it was at Shanghai—not in Peking—that they decided to carry on the work successfully begun by their predecessors. They established their headquarters at a village in a Western suburb of Shanghai called Siccawei. Its name is derived from the fact that it was the home of Shü Kuang-chi (Shü Chia-wei), the Han-lin scholar referred to above; and it was here that Father Lelec, who had previously studied in the Stonyhurst College Observatory in Lancashire, collected data concerning local climatic phenomena, etc., in the district, which paved the way for the future establishment of the Siccawei Observatory in 1873. Father Dechevrens and Father Stanislas Chevalier continued the re-

[4] The Treaty of Nerchinsk (1689) defined Sino-Russian frontiers in Siberia and Manchuria.

search work of Father Lelec and subsequently developed maritime activities including the issue of typhoon forecasts.

It is a tradition of the Order to establish such posts of observation in the countries of its adoption concerning agriculture, astronomy and weather phenomena, etc. In China the application of this principle—the primary object of which is the welfare of the people—involved the study of the origin, development and subsequent tracks of typhoons, which usually originate in the Pacific somewhere about the vicinity of Latitude 10° or 15° N., and Longitude 145° E., several thousand miles to the Eastward. These storms strike the coast of China with recurring violence during the summer months (July-September),[5] and they usually leave a trail of devastation in their wake.

About the turn of the century Father Froc, the eminent scientist, was appointed Director, and he retained that post—with a few interruptions due to illness—until his recent retirement in 1930. He proved more than a mere formal leader, and the success which he achieved may be attributed to the fact that he mixed, as it were, routine and revolution: it has been said that in the absence of statesmanship, routine and revolution alternate—in its presence they amalgamate. It should be noted furthermore, that the personnel of the Observatory was strengthened a few years ago by the temporary appointment of Father P. Lejay, an authority of international repute in the field of electrical and gravity research.

Shortly after his appointment Father Froc advocated the adoption of "Standard Time" for China in place of "Local Time". The latter differed, of course, in various districts, thereby causing inconvenience to institutions like the Siccawei Observatory in connection with meteorological activities and typhoon warnings. The introduction of such an important innovation appeared to be a formidable undertaking, which in occidental lands would at least have required the authority of the equivalent of an Act of Parliament, involving tedious discussion and vexatious delay. Father Froc invoked the co-operation of the Maritime Customs Coast Inspector, Captain Ferd. Tyler, who, in turn, explained the salient features of the question to Sir Robert Hart. The latter authorised him to approach the authorities concerned—including the Hongkong Government—and endeavour to devise a *modus vivendi* likely to prove generally acceptable to Chinese and foreign interests. India and the Malay Settlements followed suit. The Chinese Government was of course fully advised of the details of the scheme, and offered no objection to its introduction in China, on the lines indicated by the

[5] The danger period has been defined in the following manner: June, Too soon: July, Stand-by; August, Must; September, Remember; and October, All over. As a matter of fact, the "typhoon season" is seldom "all over" as early as October, and typhoons occasionally appear off the Chinese coast as late as November or December.

Customs authorities. In other words, the Coast Inspector accomplished, with no fanfare and little publicity the complicated task of arranging the details connected with establishing Standard or Zone time from the coast with a seven hour difference from Greenwich, and three other Zones, Westward to Kashgar, having respective differences of six, five and four hours.

At a farewell gathering in honour of Father Froc on his departure from China I availed myself of the occasion to render a tribute to one who had placed his abilities at the service of the public for so long a period; and whose beneficent and humanitarian work was of incalculable value to navigational interests in the Far East. The following remarks made on this occasion, coupled with his rejoinder, serve to illustrate the scope of the co-operation of the Customs Service with the Observatory in connection with the circulation of weather forecasts, etc. I spoke as follows:—

> The retirement of Father Louis Froc is an event of concern to the Maritime Customs Administration, in view of the close association which has hitherto existed between the Observatory and the Marine Department.
>
> It may be recalled that in the sixties of the past century Sir Robert Hart established Meteorological Stations at certain Offices of the Customs, and was, I believe, the pioneer of this special branch of scientific research in China. He formed the opinion that our Stations on the Coast and the banks of the Yangtze, embracing an area of some 20 degrees of latitude and 10 of longitude, would enable us to record useful Meteorological observations with but little other additional expenditure than that to be met for the purchase of instruments, and would thus assist in throwing light on natural laws and bringing within the reach of scientists facts and figures from a quarter of the globe, which, rich in phenomena, had heretofore yielded few data for systematic generalisation. It is generally conceded that the worth of the information thus circulated by the Service in those early days was recognised, and proved useful to mariners on the coast.
>
> A few years later the Siccawei authorities inaugurated a series of local observations and collected data concerning climatic conditions in the neighbourhood and elsewhere. In the year 1879 a severe typhoon swept over the Shanghai area and the astronomers at the Observatory defined the direction which it would probably pursue. As a result of the accuracy of their forecast on this occasion, the Coast Inspector, Captain A.M. Bisbee, approached them concerning the creation of a Meteorological department capable of issuing reliable weather forecasts providing advance information of the movements of typhoons in these dangerous seas.
>
> In the course of time, and after the death of Father Algue,

of the Manila Observatory, also a Jesuit, Father Froc became known as the foremost authority of his day on typhoons. There is something impressively inspiring in the work thus unobtrusively performed. Here we find a scientist and mathematician of world-wide reputation placing unreservedly his knowledge and experience at the disposal of society; and I believe that in the language of the Poet I may say of him that

> "Pleased the Almighty's orders to perform
> He rides on the whirlwind and directs the storm."

It is clear that his directions or forecasts from time to time of the tracks of the destructive typhoons which devastate our coasts with recurring violence have saved many a ship from serious damage, if not indeed from total loss; and it is equally certain that many an anxious mariner must have risen up to call him blessed. It affords me satisfaction, therefore, to have this opportunity of rendering a tribute to his work, and of acknowledging the consideration which our representatives have invariably received at his hands.

Father Froc replied:—

Permit me to express my feelings of profound gratitude, mixed with certain confusion which the kind words just spoken have awakened in me. In reality my sole merit is to have remained at my post for a long time, and to have done my utmost to fulfill the programme mapped out by the Rev. Father Dechevrens, the originator of our maritime activities, and by the Rev. Father Stanislas Chevalier, of whom I was respectively the successor, then the predecessor, and then once more the successor.

I should add that, when I was called upon by His Excellency, our President M. Paul Doumer, then Governor General of Indo-China, to institute a service similar to our own, in the neighbouring colony, I had only to fulfill the role of a docile student who attempts to make a good copy of the original.

Allow me to offer you and that fine Institution, the Maritime Customs Service, my warmest thanks, in my own name and in the name of the Observatory, as well as in the name of the Marine service of every nation of the world, which, for the last half century, has profited by that Administration.

By ourselves we could never have achieved such a result. What we have been able to do has been brought about with the generous aid which has always been offered to us by the two Municipal Councils, the Chambers of Commerce, the Shipping Companies, the Telegraph Companies, but, above all, by the Chinese Maritime Customs.

Sir Robert Hart and his successors down to this day have been to us generous and enlightened benefactors; and what shall

I say of the Coast Inspectors? Captain A.M. Bisbee, Captain W. Ferd. Tyler, Captain T. J. Eldridge and Captain H. E. Hillman, and their subordinates, with whom our relations have been most friendly and cordial.

It is thanks to them that we have in China a Meteorological system, complete in every respect, and functioning to the entire satisfaction of all. It is they who have erected those semaphores which repeat the signals the whole length of the coast from Newchwang in the North to Kiungchow in Hainan. It is they who have assisted to establish a special code of signals which is destined, little by little, it is my firm hope, to become universal for all countries in the world.[6]

In leaving this work which has been associated with so many agreeable relations for me, I do so with certain emotion, but without apprehension for the future. During the 12 years that he has so ably seconded my labours, Father Ernest Gherzi has given the most reassuring proofs of his ability. He is at one with me in believing in the capital importance of this service, which, moreover, he has controlled with complete satisfaction during my periods of absence, and for which he will, I am sure, continue to maintain the high traditions of the past.

Therefore, when our Superiors, a few months ago, while keeping me, so to speak, in the offing, charged him officially with the title of Director of the Meteorological Observatory, I was happy to see this work of aids to mariners placed in such good hands. A work which has been, and will remain, the principal preoccupation of Siccawei. I place, therefore, without fear, this burden on his shoulders; a burden which is not rendered lighter by the addition to our many solicitudes of the interests of the gentlemen who navigate the air.

Father Gherzi, the distinguished seismologist, succeeded Father Froc in 1930 as Director of the Observatory. Some years ago, he added another weather-weapon for use in Shanghai known as the Seismograph, for registering earth tremors; and under his direction the Observatory was furnished with the most modern equipment in this connection, which places it among the foremost seismological stations of the present day. Subsequent developments enable advance

[6] When the Inspector General authorized the Marine Department to co-operate with the Observatory and display its storm-warnings along the coast of China, it was considered advisable to substitute symbols or shapes for flags, as they were more easily distinguished at long distances. The Coast Inspector, Captain W. Ferd. Tyler, in consultation with Father Froc, devised the required geometrical emblems, and tested them on Customs buildings and lighthouses before they were officially adopted. It was believed that the new system would receive general recognition, and that in course of time it would be placed on an international basis. He also took a leading part in respect of the introduction of "Standard" or "Zone Time" in China, as mentioned above.

information of approaching storms to be detected and recorded by means of this instrument. It seems that waves reach to the bottom of the sea regardless of the depth, and then circulate round the earth: the seismograph gives timely warning of such movements and thus helps to reduce some of the hazards which threaten ships at sea, and may even lessen the cost of storm detection. It is appropriate to subjoin certain details regarding the latter-day organisation of the Observatory, and, this premised, I am authorised to draw upon the vivid annals of the institution itself for information on this interesting topic, as follows:—

> . . . The French missionaries have founded many educational establishments at Shanghai, namely, a university, colleges, primary and secondary schools, schools for teachers, orphanages and technical work-shops. These are grouped around the Observatory of Siccawei and number about 5,000 Christians.
>
> In these surroundings, the little scientific station has rapidly developed. Siccawei has become the centre of the largest private meteorological organisation in existence. It is connected with a network of stations from Siberia to Manila and from Indo-China to Guam, in the middle of the Pacific. Its laboratories for scientific research have been gradually grouped together, till they now form the "Earth Physics Institute", the most important of its kind in Asia.
>
> Thanks to the help of the Chinese Maritime Customs Department which has stations all along the coast, thanks also to the Telegraph Companies, which undertook to transmit free of charge meteorological information, Siccawei soon became connected with about 50 permanent outposts. To these we may add, now that wireless telegraphy has come into general use, all the ocean-going liners.
>
> Two hundred messages come in daily, giving data for a weather chart issued twice a day which furnishes particulars by means of which the fearful typhoons of the Chinese seas may be traced with the utmost accuracy. To be convinced of the importance of this work, one of these storms should be seen beating down on Shanghai. Merchant-vessels and liners are ready to leave port; the captains are often uneasy, and come for advice. The forecast posted up on the "Quai de France" may not be complete enough; and the telephone, already overworked, is not sufficient; then one of the Fathers goes to our semaphore on the Bund and remains there, to give information, as long as there is danger. The wind blows with great violence, and changes rapidly, especially as the centre of the storm approaches. Fortunately also, the messages begin to arrive in larger numbers: the vessels still at sea have been warned, and consider it a duty to dispatch information in the greatest possible detail. It is a thrilling moment for the Father in charge of forecasting, when,

conscious of his responsibility over an immense fleet, he sees upon his chart the typhoon touch the coast or approach it too closely, and signals to the Customs Harbour-Master to fire the usual cannon-shot. This latter alarm announces in a deep and doleful voice, amidst the roaring of the winds, that even the river is dangerous, and that no ship should leave port. When one considers that during the last 50 years, *more than 1,000 typhoons* have been forecasted and signalled from Siccawei, it may be imagined what a large number of ships have escaped being driven ashore among the rocky islands that infest the coast of Indo-China.

It can be said that these warnings, issued formerly from the semaphore, but during the last fifteen years also by the radio-telegraph of the French settlement, have saved thousands of lives. And it is chiefly because the Observatory has made the routes to Shanghai, once so ill-famed, as safe as any other, that it has won the favour it enjoys with seamen the world over. Thus testimonials of approval have often encouraged the Fathers in their work. They employ one and all the same language, be they in the nature of a decoration for the Director at the hands of the French Government, or of an editorial like the following in a famous British naval review: —

> "The Staff of Siccawei has merited the gratitude of the entire shipping world. Still another proof is provided of the very high degree of efficiency obtained at Siccawei Observatory and of the unflagging interest and labour which its staff bring to bear in their voluntary and unremitting efforts on behalf of the navigators in the Far East. To the staff of Siccawei Observatory is due a debt of thanks which nothing can ever adequately repay."

As the result of circumstances, the work of forecasting at Siccawei has taken on a role of exceptional importance. But as in all well-organised meteorological bureaux, this daily tabulation of results for the benefit of the public absorbs only a part of the activities of the staff. It does not properly constitute a scientific work, and it would lessen the importance of the Observatory to concentrate exclusively on this service to humanity, however important it may be. . . .

Seismology came later, but it came furnished with the most modern instruments, including a Wiechert horizontal pendulum, the large model, weighing about 1,200 kilograms; and a Galitzin vertical seismograph with a photographic recorder. To these were added a whole series of other less sensitive seismographs for the study of earthquakes nearer at hand which occur more frequently.

Siccawei thus equipped takes its place amongst the foremost seismological stations. It regularly publishes its observations and cables its principal data to the International Union. The "Notes

of Seismology" comprise a number of studies on the production of special microseisms by the typhoons; another study in collaboration with Loh-Kah-Pang—a substation of Siccawei at the adjacent hills some 10 miles distant—on the influence of earthquakes on the magnetic instruments; and particulars about the two great upheavals which desolated North-western China in the last 10 years, are on record.

Till now, apart from some observations, a little out of date, atmospheric electricity properly so-called has not been specially studied, but some later researches begun some 27 years ago at the Earth Physics Institute in Paris, and some observations made at the "Pic du Midi" (France) Observatory on the propagation of storm perturbations of the electrical field, may result in the creation of a new Branch, when resources permit. . . .

It should be recorded, in this connection, that Father Gherzi has introduced a new method of forecasting the weather and the movement of typhoons. His theory that the so-called "group-microseisms" registered in typhoon weather should be attributed to the storm itself and not to the breaking of the waves produced by the typhoon, was first advanced in 1923, although it was not accepted until 1945 when the U. S. Navy installed seismographs in the Pacific Ocean Islands, to check, based on this idea, the position, etc., of the typhoon centre. His method of forecasting weather and the movement of near-by typhoons consists in checking the type of echoes received from the Ionosphere reflecting layers, when pulsing on a chosen frequency (the 6 Mc band). A reflection (or echo) from the E layer indicates that the type of weather on the following day will be governed by an invasion of maritime air; from the F1 layer that Polar (in this region Siberian) cold and dry air will invade the locality; while from the F2 layer, that tropical damp and warm air will make the weather on the following day. (E layer: 100 km above the ground; F1 layer: 220 km above; F2 layer: 450 km above). In Father Gherzi's opinion, this method will eventually be adopted at all the weather stations, although the reason for such a reliable correlation between the Ionosphere and the lower atmosphere is not yet fully understood.

I should like to observe, in conclusion, that in order to arrive at a clearer conception of the outstanding and disinterested services rendered by the Jesuits in China, it is well to bear in mind the unfavourable conditions in which they lived, and the perils to which they were frequently exposed; and more especially to remember the moral, material and intellectual isolation in which they were compelled to work.

News Items

BOSTON COLLEGE

Department of Chemistry. *Editor's Note.* Progress Report Number 21 of the Committee on Professional Training of the A.C.S. shows some interesting data. Chemical & Engineering News, *28*, 768 (1950). The number of chemistry bachelors from 165 schools certified for the academic year 1948-1949 shows that 38 graduated from Boston College out of a total of about three thousand over the country. Thus Boston College had the fifteenth largest number of chemistry bachelors out of the 165 schools on the national list. Further it showed the largest number in the metropolitan Boston area and the largest number among the listed Catholic schools of the country.

In the number of master's degrees awarded Boston College came twenty-eighth in a field of 124 colleges. This number was exceeded in the metropolitan area only by Harvard, and among the Catholic schools listed, only by Fordham. Boston College does not grant the doctorate in chemistry.

Department of Physics. The 1949-1950 Program of the Boston College Chapter of the American Institute of Physics: Oct. 6, 1949, Powder Metallurgy (illustrated) by Alden Burghardt of the Watertown Arsenal; Oct, 20, 1949, Industrial Color Control, by John W. Power, Jr., of the International Printing Ink Corporation; Nov. 3, 1949, Movie: Mr. Bell; Nov. 17, 1949, Time Systems (demonstrated) by David Birtwell of the International Business Machines; Dec. 15, 1949, Naval Ordnance Laboratories, Job Opportunities, Charles A. Sahigian, '50; Feb. 2, 1950, Aircraft Gas Turbine Jet Propulsion (illustrated) by John O'Connor of the General Electric Co.; Feb. 16, 1950, Acoustics (illustrated) by Vincent Kraeger of the Ultrasonics Corp.; Mar. 2, 1950, Cosmic Rays (illustrated) by Rev. John A. Tobin, S.J., staff; Mar. 16, 1950, Selsyn Systems (demonstrated) by William Canty '50; Mar. 30, 1950, Electrical Instruments (illustrated) by J. M. Whittendon of the General Electric Co.; Apr. 20, 1950, Kinetic Theory of Gases by Dr. Andre deBethune of the chemistry faculty; Apr. 27, 1950, Election of Officers; May 4, 1950, Divorce of Science and Philosophy by Edmund Mockus '50; and May 11, 1950, Film on Acoustics.

FORDHAM UNIVERSITY

Department of Chemistry. Research for High Temperature Insulation for Army Air Force. The present grant from the Air

Material Command, Wright Field, has been renewed for the coming year, and $54,000 allotted to this work. Gas furnaces have been installed, and new electric furnaces are being constructed to produce the high temperatures needed for the production and testing of new materials.

Pilot Plant Laboratory for Organic Unit Processes. This is housed in the new steel building, which also contains a separate room for the storage of acids and inflammables, and a shop. The front of the building is open like a porch for the erection of equipment that may be operated out of doors. Some of the equipment, built or in the building stage are: a 10 gallon nitrator of stainless steel, a fluid flow measuring machine, heat exchanger, and a 14 ft. fractionating column.

Instrumentation Laboratory. A course in Instrumental Methods of analysis was started by the late Dr. W. A. Hynes last year. This course is now under the direction of Dr. Michael Cefola, who came to us from the G. E. Knolls Atomic Energy Lab. in February 1950. A part of the old General Chemistry Laboratory has been partitioned off to make the Instrumentation Laboratory. Some of the special instruments used in the course are: a photoelectric colorimeter, mercury electrode polarograph, G. E. X-ray diffraction equipment, polarizing microscope, Beckman spectrophotometer, and Type K equipment for potentiometric and conductimetric measurements.

Dr. Cefola plans the installation of high vacuum equipment for atomic energy measurements, and proposes to do work in radiochemistry and with radioactive tracers.

Light-Scattering Laboratory. Under the direction of Dr. F. F. Nord work has been and is being done in the application of light-scattering methods to organic problems. Dr. Milan Bier, who received the doctorate here in February 1950, designed and supervised the construction of two machines for the measurement of the ratio of Tyndall or scattered light to that of incident light transmitted through colloidal protein solutions.

This laboratory was blocked out of the basement, and is air-conditioned. Much of the work already done in determining the weight and structure of protein molecules has been under a U. S. Navy research program.

COLLEGE OF THE HOLY CROSS

Department of Chemistry. Eight graduate students have been selected for next September. The selection statistics might be interesting. There were 38 inquiries; 23 applications of which four declined; eight refusals by us; three alternates named by us; four appointments from other colleges; three from the present graduating class at Holy Cross and one who graduated a few years ago.

On February 13 the College was host to the Central Massachu-

setts Section of the American Chemical Society. Prof. Harold G. Cassidy of Yale University spoke on the separation of organic mixtures by absorption techniques. Prof. O. L. Baril of this department spoke at Assumption College in Worcester, March 31, on Chemistry as a Profession; April 14, at the Bartlett Career Conference for high school students in Webster, Mass., on Careers in Science. He was recently re-nominated to the office of Treasurer in the local A.C.S. section.

Department of Biology. According to the Worcester *Telegram* for Wednesday, April 12, 1950, ground was broken for a new biology building on the upper campus, west of Beaven Hall. It will be a three story structure in the hillside near College Street, and completes the quadrangle between Wheeler and Beaven Halls and the College Library. It features faculty offices and lounge, library, micro-technic, photomicrography, genetics laboratories, hot-house, and a museum named in honor of Professor Malumphy, along with the usual laboratories that commonly denominate a biology department. Notice was also carried by the New York *Times*, the Boston *Herald* and other newspapers. Of Maginnis and Walsh design, the Charles Logue Building Co. of Boston has the contract. A figure of $500,000 has been released as the cost of the building, and June 1951 as the expected date of completion.

LOYOLA COLLEGE, BALTIMORE

Besides the four staple eight credit courses for the Chemistry majors, the following courses are now in session: Biochemistry (8 credits), Advanced Quantitative Analysis (4 credits), Feigl Spot Analysis (2 credits), Physical Measurements (1 credit). During a Spring-Summer term (May 29-July 20), courses in Toxicology, Electrochemistry, Analytical Chemistry will be offered by the staff. Three members of the 1950 graduates have been awarded, and accepted, Assistantships at Fordham, Purdue and Yale.

WESTON COLLLEGE

Department of Chemistry. The department has acquired a new Geiger-Muller counter. The counter was designed and developed by Mr. Pierre Gouin, S.J., a Canadian Theologian, now of this house and attached to the Ethiopian mission. It was designed for qualitative demonstration purposes. The addition of an intensity meter has been proposed which will allow some quantitative demonstrations to be performed with the counter.

Reviews and Abstracts

STATISTICS ON CHEMICAL RESEARCH IN SOME OF OUR LIBERAL ARTS COLLEGES

Rev. Bernard A. Fiekers, S.J.

Chemical Research in Liberal Arts Colleges is the title of a report by John R. Sampey of Furman University on sixty-two liberal arts colleges which have been credited with contributions to the *Journal of the American Chemical Society* between the years 1927 and 1948. Many of *our* institutions were not listed, evidently because they do not come under the definition of Liberal Arts Colleges used by the reporter. Statistics are given in the number of pages contributed by each college and this number is properly corrected for the change in the format of the journal which took place at the end of 1937. Canisius College contributed 17.5 pages; Georgetown, 7.6; Holy Cross, 21.0; St. Peter's, 16.2; total listing, 1238 pages by all the liberal arts colleges listed, out of the 70,957 pages published by the journal over this era. Holy Cross College is mentioned in the discussion of the geographical distribution of the publications: "Six liberal-arts colleges of Massachusetts published one-third of the total number of pages here reported—Amherst (94.7), Holy Cross (21), Mt. Holyoke (214.2), Wellesley (29.9), Wheaton (2.5) and Williams (7.8)." Insertion of corresponding numbers in above quotation was done by this writer.

A supplementary study[2] by the same author is entitled: *Chemical Education in Liberal-Arts Colleges 1934-48.* Data are here given on the contributions of 109 institutions, similarly defined, to the *Journal of Chemical Education.* Holy Cross is listed for 4 contributions; John Carroll, for 1; Loyola in Baltimore, for 2; and St. Joseph's for 1. Notice that the unit in this study is articles, not pages. About 250 articles were contributed by all listed institutions over this period.

In a still subsequent study, Chem. Eng. News, *28*, 860-1 (1950), by the same author, entitled: *The Effect of War on Research in the Liberal Arts Colleges,* thirty-seven liberal arts colleges are listed for their contributions to the Journal of the American Chemical Society for a) the War Period 1942-1945 and b) the Postwar Period 1946-1949.

The listings for our colleges are: Canisius a) 0.3 pages; Holy Cross b) 0.5 pages; St. Joseph's b) 0.3 pages; St. Peter's a) 2.6 pages. There are of course innumerable objections to this type of sampling

[1] Journal of Higher Education, *20* no. 4, 208 (1949).
[2] Journal of Chemical Education, *27*, 69-70 (1950).

and to the conclusions drawn. The references, facts, and figures involved are otherwise interesting to us, and probably of value.

The Alchemists, Founders of Modern Chemistry by F. Sherwood Taylor, Oxford. Those interested in Alchemy or the Philosophic implications of these strange works, will find a new and refreshing viewpoint in this book from the pen of the Curator of the Museum of the History of Science in Oxford. Dr. Taylor is a convert to Catholicism. A few brief quotations will set the tenor of the book.

"They sought not only to make gold, but to perfect everything in its own nature, and this is not far from the ideal of those who today would apply modern science as it should be applied." Page 3.

"The alchemist, other than the mere multiplier of metals, sought a complete scheme of things in which God, the angels, man, animals, and the lifeless world all took their place, in which the origin of the world, its purpose, and end were to be clearly visible. Such an object is clearly unattainable by science, for it includes the objects of science, philosophy and religion. It follows then that the alchemist's attitude and method differed widely from that of the modern scientist." Page 232.

"The alchemists, indeed, felt a strong moral responsibility for the result of their work, a responsibility that is not always acknowledged by the scientists of today."

"The material aim of the alchemists, the transmutation of metals, has now been realized by science, and the alchemical vessel is the uranium pile. Its success has had precisely the result that the alchemists feared and guarded against, the placing of gigantic power in the hands of those who have not been fitted by spiritual training to receive it. If science, philosophy and religion had remained associated as they were in alchemy, we might not today be confronted with this fearful problem." Page 233. *G. F. Hutchinson, S.J.*

Astronomical Appreciation of the Gregorian Calender by J. de Kort, S.J. Pontificia Academia Scientiarum. Acta, *13* no. 4, pp. 55-62. *Exchange item. Editor.*

Churchmen Famous in Medicine—Athanasius Kircher, S.J. The *Merck Report* (58 (1), 19-24, January 1949) carries an article on *Churchmen Famous in Medicine* by W. K. Frankel which might be of interest to all. In it a rapid survey of the history of medicine in the Christian era is made with special emphasis on contributions made exclusively by the Catholic clergy. Of special interest is the prominence given to Father Kircher (1602-1680) in his idea of the living contagion. Two quarter page cuts that deal with Kircher appear; his portrait and the title page of his *Scrutinium Physico-Medicum*. Kircher's life is outlined in brief and the following appraisal of his contribution is given: "In his *Scrutinium pestis* he clearly realized the connection between germs and disease. Kircher's important contribution to the development of medical thought is his idea

of the *Contagium animatum*, the living contagion. He postulated this contagion as a positive factor of many widespread, disastrous epidemics and diseases, even though the minute 'animals' observed with the aid of his inadequate microscope, were not *bacilli pestis*. It is significant here to note that in the middle of the seventeenth century, Kircher stated that 'flies feeding on the juices of the diseased and dying, hurry off and deposit their excretions on food, and persons eating it are infected'." *B. A. Fiekers, S.J.*

Forty Years of Research on Liquids by Geo. Antonoff (Fordham), *Sci. Counselor, 11,* 20 (1948). Summarizes physicochemical evidence for liquid *structure*. Theory for fluctuation of liquid properties is offered. *B. A. F., S.J.*

Kircher Review. The *Kircher Review* is a mimeographed monthly published by the Tri-beta Alpha Theta Chapter of the Department of Biology at Canisius College in Buffalo under the direction of the Reverend John A. Frisch, S.J. The Review commenced publication in November 1948. An article on the *Title of our Review* presents a very well written life of Father Kircher and the Review is dedicated to his honor. The second issue carries a Christmas message from Father Frisch; and the third issue presents the first of a series on the history of the Department of Biology at Canisius.

It is probably too early to describe the review in detail, as it is not as yet clear what further publication policies will be adopted. It is interesting to note, however, that alumni items are featured; that reports of the Mendel Club and the Chapter at Canisius and elsewhere are highlighted; that project reports, abstracts, field trips, book and lecture reviews, along with a lively correspondence section are included. This is certainly eloquently indicative of a good health department at Canisius where the more material aspects of science are vitalized and humanized. May the youthful vigor of the new project continue and take its place among the leaders in the field. *Ad multos annos! Ed.*

Since the above material was set up at the press another volume of the *Kircher Review* is nearing completion. The history of the biology department has been concluded, running through the issues volume I., no. 3 through volume II., no. 1. The second volume is done in standard 8½ by 11 mimeo paper as the first but has some new features. There is a double column setup with justified typed lines. There is a new mimeoed cover design for each issue in the second volume and each cover suggests an appropriate biological, seasonal or medical motif.

Industrial Education, Joseph E. Seagram & Sons, Inc., Division of Education, Louisville, Ky. 1948. This is an 88 page illustrated booklet published for prospective technical employees of the company. A plan is laid whereby earlier education is evaluated and supplemented by education within the company. Becoming conver

sant with the company's operations in a thorough and modern way is outlined. Opportunities for further specialized "graduate" study outside of the company are presented. The booklet should be of interest to counselors. *B. A. Fiekers, S.J.*

The Lifetime Battery by H. Manchester. *Reader's Digest, 53,* 79-82 (Sept. 1949) from *Popular Science Monthly.* The advantages of the nickel-cadmium accumulator are described; comparison with conventional types in this country are made; and the forty years delayed recognition in this country, deplored. *B. A. Fiekers, S.J.*

Photographic Magnitude of Stars Brighter Than $7^{m}.75$ Between $+75$ and $+80°$ Declination by J. de Kort, S.J., printed by J. Enschede in Haarlem, Netherlands, 1949. 21 pp. in English with brief abstract in Dutch. Author's doctoral dissertation before the Imperial University of Leyden. Author's present address: Specola Vaticana, Rome, *Exchange item. Editor.*

Lazzaro Spallanzani: Founder of Experimental Physiology by E. Tortonese (Turin). *Endeavour, 7,* 92-96 (1948). This article is listed by way of "notice" for the following reasons: In the article, Spellanzani is said to have attended the Jesuit College at Reggio, Italy, to have been ordained to the priesthood and to have returned to Reggio as Professor of Logic. Other assignments in his life have a familiar ring. Possibly he was a Jesuit who lived on into the time of the Suppression. 1729-1799. *B. A. Fiekers. S.J.*

Biochemical Preparations, Vol. I., edited by Herbert E. Carter, Wiley, N. Y., 1949. Following the general plan of Organic Syntheses, this is the first volume of a work intended to fill a similar need in the field of Biochemistry. Not only does it list well known names on its Advisory and Editorial Board, but the first volume does credit to those names, and gives promise of high quality in succeeding volumes.

The objective is to provide tested laboratory methods for preparing compounds of biochemical importance for research that are not commercially available. A secondary aim is to give typical preparations that might be used for training of advanced students, and this reviewer is pleased with the results. It is not a laboratory manual for advanced course work, but it will provide much suitable material for such a course because of the variety of technics involved.

The first volume is only a part of a large program, and, necessarily, its contents cover a very limited area,—sixteen preparations are listed, of which four are straightforward organic syntheses. Each preparation is relatively difficult, and although the procedures are detailed and supplemented with footnotes and references, some maturity of judgment is required in interpreting the procedure. *Rev. A. F. McGuinn, S.J.*

The Cold War in Anti-histamics, a Staff Report in Chem. Eng. News, *28*, 846-8 & 858 (1950). This is a report of general interest to the layman and of technical interest to the chemist and other scientists. Antihistamines have proved to be the fastest selling item on the retail drug market since their introduction last fall. The volume of trade in them is estimated at about $15 million during the first ninety days; the advertising expenditure at about $10 million.

Paul de Kruif's article in the *Reader's Digest* for December 1949 announced that Anahist has been released by the Food and Drug Administration for non-prescription sales, an announcement that the manufacturer was not allowed to make. A paper to appear in the New York State Journal of Medicine, also announced by de Kruif, reporting the trials of the new remedy at Sing Sing and at the Maryknoll Convent, eventually appeared in another journal. The volume of manufacture of antihistamines in general might have been suspected from earlier reported shortages of intermediates and reagents, such as lithium amide (20 fold volume), anisic aldehyde, alpha amino pyridine, diethyl amino ethanol, thionyl chloride and thiophene.

Chemically, most of the antihistamines are substituted ethylene diamines or mono ethanolamines. One of the terminal nitrogens has N,N dialkyl (generally dimethyl) substitution. The other amino, oxygen or carbon bridge, as the case may be, is attached to two aromatic or heterocyclic rings. There is also considerable deviation from this pattern.

A study of reactions by the FDA, the AMA and the Public is included in this study. Ed.

Introduction to Biological Latin and Greek by Dr. P. H. Yancey, S.J., Professor of Biology, Spring Hill College, Spring Hill, Ala. 3rd ed . revised reprint from *Bios, 15*, no. 1, March 1944; also Bios Classroom Series no. 1, to be ordered from F. G. Brooks, Mount Vernon, Iowa, at $0.25 per copy. 24 pp.

Journal of the Boston College Physics Society is the official publication of the Boston College Chapter of the American Institute of Physics. Volume I., no. 1 is dated October 1949, and three issues have already been published. Its format follows the single column double spaced 8½ x 11 in. style, wire-clip bound between sturdy brown dust covers. The issues contain timely articles in physics and feature well selected fillers and very neatly executed cuts. The first number contains the by-laws of the Chapter. The later issues have about 45 pages each. *Ad multos annos.*

A Multi-Purpose Conductivity Demonstration by Frederick B. Dutton (Michigan State), *Sci. Counselor, 11*, 97 (1948). This embodies a combination of several previous suggestions. It features two 30 watt lamp indicators: the first is in series with the electrodes; the second, in series with a rheostat. Illumination for a given sample of

solution is matched to same intensity in second lamp so that comparisons of conductivity are possible. Suggests, among other experiments, the comparison of separate conductivities of NH_4OH and HAc with the conductivity of the mixed solutions. Conductivity of distilled water using Neon bulbs, and conductivity titrations, (barium hydroxide and sulfuric acid) are also suggested. *B. A. Fiekers, S.J.*

Nickel Plate Without Electricity. *Science Illustrated,* p. 90, Feb. 1948. This is an account of a new method, developed at the U. S. Bureau of Standards. $NiCl_2$ (30 g L), NaH_2PO_2 . $?H_2O$ (10 g L), NH_4Cl (50 g/L) and sodium citrate (100 g/L) constitute the plating bath. Plating temperature: 90° C. Time: about 2 hr. Usual cleaning recommended. Ventilation recommended on account of ammonia. *B. A. Fiekers, S.J.*

The OXO Process by E. H. Riddle. *Rohm & Haas Reporter,* 7, 21 (1949). An investigation, carried on at the Bureau of Mines in 1930, was later taken up by chemists in Germany and developed into a process which gets its name from the German for aldehyde structures; for the production of aldehyde is the first step in the process. Pilot plant operation at Rohm & Haas now produces the following chemicals by this process: nonanoic acid, nonylamine, nonyl aldehyde cyanohydrin, alpha hydroxy decanoic acid, octadecenyl aldehyde, octadecyl alcohol. In studying the Fischer Tropsch synthesis at the Bureau of Mines, it was decided to test the effect of ethylene on the CO and H_2 mixtures in the presence of the F-T catalysts. The Germans then generalized the reaction for unsaturated compounds of the ethylene type. When the idea returned to this country after the war, the R. & H Co. specialized on the use of di-isobutylene because it gives a single product in the Oxo reaction and because of its general availability as an intermediate in the production of high-octane gasoline. The compounds produced by this company promise to have a wide variety of uses. *B. A. Fiekers, S.J.*

Paradoxes of the Infinite, by Bernard Bolzano. Translated from the German of the Posthumous Edition of Dr. Fr. Príhonský with a Historical Introduction, by the Rev. Donald A. Steele, S.J., D.Ph., of this Association. Bernard Bolzano was born in 1781, in Prague, the son of an art dealer, the Paradoxien were written at the close of his life. The present translation of the Paradoxien is accompanied by a Historical Introduction which puts under rapid review the entire work of Bolzano in mathematics and in logic. He was a teacher inspired and inspiring and one of the pioneers in the reconquest of logic in Mathematics. Demy 8vo. About 21s. net, edited from Routledge & Kegan Paul Spring Announcement, 1950.

Pre-med. Bulletin. This is probably the first venture into journalism by the department of biology at Boston College. Volume

I., no. 1 of this item is dated December 15, 1949. It is evidently a lithographed work which is replete with student articles, notes, faculty interviews, notices, cartoons and the like. Apart from its value in student training, both in generosity to contribute and in the experience gained from the contributions, the *Pre-med. Bulletin* is a valuable Jesuit document that shows the work being done today, the interests of our men and our students, the record of accomplishment in both its current and historical articles. It is probably too bad that generous margins are not provided to facilitate the saving of this contribution for posterity. *Ad multos annos! Ed.*

Science, Education and Human Values by H. S. Taylor Dean of Grad. School, Princeton Univ. *Bull. Assoc. Am. Colleges,* 35 25-32 (1949). Human values are jeopardized in this age of science and increasing secularization. Science does not touch upon purpose and goal; it may aid in their achievement; but not in the selection of man's desires. Many scientists are reaching beyond and developing a natural theology. Integration of social effort towards a desired goal is called for; not disintegration which is created by current emphasis on specialization in knowledge. Limitations of science are to be recognized; sanctity of the "person" emphasized; spiritual values, universally sought. Instances for argument are liberally provided and well documented. *B. A. Fiekers, S.J.*

Subsurface Geologic Methods: A symposium by L. W. LeRoy and H. M. Crain, editors, Golden Colo., Colo. Sch. Mines, 1949. 826 pp. Reviewed by Rev. D. Linehan, S.J., of THIS ASSOCIATION in Science, *111,* 184 (1950).

Zoologische Plaudereien by Dr. Franz Heselhaus, Verlag der Buchgemeinde, Bonn, 1948. 312 pp., $2.90. Rev. Franz J. Heselhaus, is listed in the catalogus of the Province of Lower Germany: b. jn 15 '82; intr. Apr. 23 '03; vws, Fb 2 '23; an mag. for '49, 21; stationed at Coll. and House of Studies Büren in W. These zoological chats do not belie their title. The chapters include the anatomy, morphology physiology and psychology of animal behavior along with many other chapters that lead up to the heredity, evolution and soul problems. The relation of man to animal is always stressed. Chats are not textbooks; they supplement the text. In this work there is to be found a deft analysis of subject and concepts. The style is often witty as for example when the author states that tracer elements are used to hang the bell on the cat. Teleology is stressed; correlations are frequently made; and alternative explanations of so-called dysteleology are proposed. See also "Physikalische Plauderein" and/or "Chemische Plaudereien", This Bulletin, *15,* 139 (1938).

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It would be appreciated if any errors of omission or commission are brought to the attention of Rev. Vincent F. Beatty, S.J., Secretary, A. A. J. S., (esd.), Loyola College, 4501 North Charles St., Baltimore 10, Md.

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